

***Distocercospora curvulata* sp. nov. from northern India**

SANJEET KUMAR VERMA, SANJAY YADAV, RAGHVENDRA SINGH*

Centre of Advanced Study in Botany, Institute of Science, Banaras Hindu University, Varanasi, U.P.,
India 221005

*CORRESPONDENCE TO: drsinghtaxon@gmail.com, singhr.bot@bhu.ac.in

ABSTRACT— A new species of asexual foliicolous fungus, *Distocercospora curvulata*, discovered on living leaves of *Causonis trifolia* from Uttarakhand, India, is described and illustrated.

KEY WORDS— hyphomycetes, *Mycosphaerellaceae*, phytopathogenic fungi, taxonomy

Introduction

Cercospora is the largest genus of asexual fungi which is commonly referred as cercosporoid fungi belonging to *Mycosphaerellaceae* (*Mycosphaerellales*, *Ascomycota*). It represents a large group of leaf spotting, plant pathogenic species, causing diseases on a wide range of hosts (Crous & Braun 2003; Braun & al. 2013, 2016). The distoseptate nature of conidia is exhibited by *Distocercospora* N. Pons & B. Sutton and *Distocercosporaster* Videira & al. within the cercosporoid complex (Braun & al. 2014, Videira & al. 2017). Morphologically, *Distocercospora* is characterized by plant pathogenic species, stromata lacking to well-developed; conidiophores macronematous, fasciculate, simple to strongly branched, septate; conidiogenous cells integrated, terminal to intercalary, loci protuberant, thickened and darkened; conidia solitary to rarely concatenate, mostly obclavate to cylindrical, single to several transverse distosepta or a mixture of eu- and distosepta, hila thickened and darkened (Braun & al. 2014, Videira & al. 2017). *Distocercospora* differs from *Distocercosporaster*, which has stromata composed of subhyaline to brown

swollen hyphal cells, short conidiophores, rim-like and distinctly thickened conidiogenous loci on terminal conidiogenous cells, and frequently catenate conidia (Videira & al. 2017).

A survey of plant pathogenic fungi for systematic exploration of conidial fungi was carried out in Uttarakhand and a new fungal species was collected on living leaves of *Causonis trifolia*. Morphologically, this fungus resembles *Distocercospora*. A number of conidial fungi have been described from India (Kumar & Singh 2015a,b, 2016; Singh & Kamal 2011; Awasthi & al. 2016; Kumar & al. 2012a,b, 2018; Kushwaha & al. 2020; Singh & al. 2011, 2012, 2013a,b, 2014a,b, 2019, 2020) suggesting that the diversity of such fungi is still insufficiently known in this region.

Materials & methods

In September 2019, an infected leaves of *Causonis trifolia* were collected from Valley of Flowers National Park, Uttarakhand during field survey conducted for collections of phytopathogenic fungal samples. Fungal samples were kept in sterilized polythene bags. The collected samples were processed by following the standard techniques (Hawksworth 1974, Savile 1962). Slides for microscopic examination were prepared by scraping taken from infected area of freshly collected materials and mounted in clear lacto-phenol cotton blue mixture. The microphotographs of fungal propagules were taken by using Magnus camera (MIPS CMOS) attached with an Olympus trinocular compound microscope (CH20i-TR). The detailed morphological observations were carried out at different magnifications (450× and 1000×). Measurements were made of 20 each morphological features. The holotype specimen was deposited in the Ajrekar Mycological Herbarium, Ajrekar Research Institute, Pune, India (AMH) and the isotype material was retained in the Mycological Herbarium, Department of Botany, Banaras Hindu University, Varanasi, U.P., India (MH-BHU).

Taxonomy

***Distocercospora curvulata* S.K. Verma, Sanj. Yadav & Raghv. Singh, sp. nov.**

FIGS 1–3

MB 838244

Differs from other *Distocercospora* spp. by the presence of euseptation along with distoseptation in conidia.

TYPE: India, Uttarakhand, Valley of Flowers National Park, 30.7333°N 79.6333°E, on living leaves of *Causonis trifolia* (L.) Mabb. & J. Wen (*Vitaceae*), 23 September 2019, coll.

Raghvendra Singh (**Holotype**, AMH 10308; **isotype**, MH-BHU 35).

ETYMOLOGY: Latin, referred to the curved conidia.



FIG. 1. *Distocercospora curvulata* on *Causonis trifolia*. a. Host plant in natural habitat; b. Symptom on lower surface of leaf. Scale bar: b = 5 mm.

INFECTION SPOTS hypogenous, discrete, initially whitish, later on become brown to blackish brown, surrounded by whitish margin, circular, 3–6 mm. COLONIES hypophyllous, effuse, velvety, initially whitish, late on turned to brown to dark blackish brown surrounded by white margin. MYCELIUM internal, composed of branched, septate, smooth, thick-walled, olivaceous to light brown hyphae. STROMATA well-developed, internal to erumpent, pseudoparenchymatous, brown to dark blackish brown, $12\text{--}46 \times 8\text{--}30 \mu\text{m}$ diam. CONIDIOPHORES macronematous, densely fasciculate, arising from stromata, cylindrical, erect to procumbent, straight to flexuous, geniculate, unbranched, 1–7-septate, thick-walled, olivaceous to light brown to mid brown, lighter towards at apex, $(22\text{--})34\text{--}92(\text{--}103) \times 3.5\text{--}7 \mu\text{m}$. CONIDIOGENOUS CELLS integrated, terminal to intercalary, mono to polyblastic, proliferation sympodial, scars conspicuously protuberant, thickened and darkened, $1.5\text{--}2 \mu\text{m}$. CONIDIA solitary, dry, acropleurogenous, acicular, narrowly obclavate to subcylindrical, curved, rarely straight, 0–5-distoseptate and 0–3-euseptate, sometimes constricted at the septa, thin-walled, smooth, apex obtuse, base obconically rounded, light olivaceous-brown to light brown, $22\text{--}80(\text{--}95) \times 2\text{--}7 \mu\text{m}$, hilum sometimes projecting, thickened and darkened, $1.5\text{--}2 \mu\text{m}$ wide.

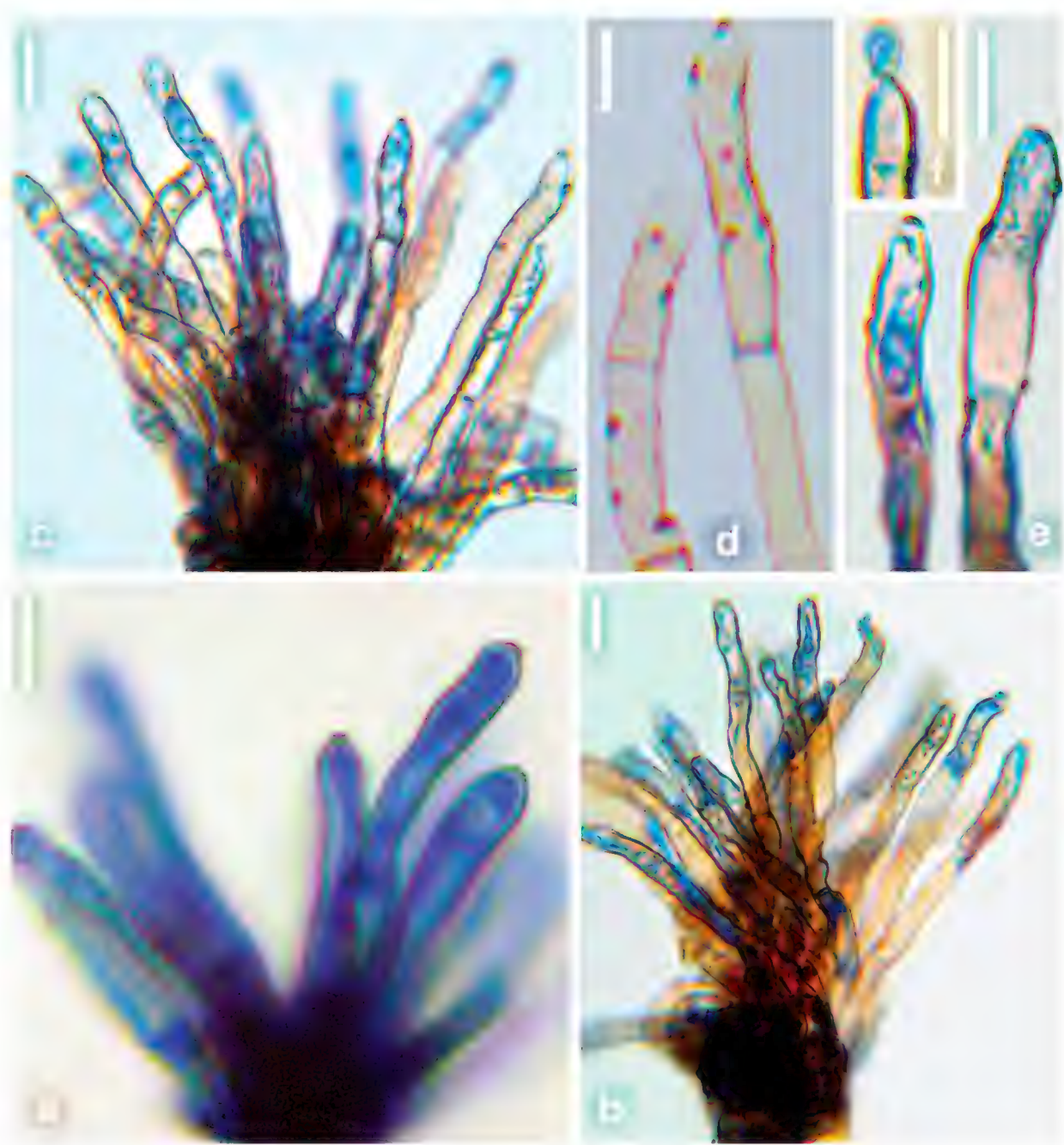


FIG. 2. *Distocercospora curvulata* (ex holotype, AMH 10239). a. Initial stage of development of conidiophores; b, c. Stromata with fasciculate conidiophores; d, e. Conidiogenous cells with protuberant loci; f. Conidiogenous cell with developing conidium. Scale bars = 10 μ m.

COMMENTS— Three *Distocercospora* are currently accepted (www.indexfungorum.org; accessed 13 December 2020). Morphologically, the conidiophores of *D. indica* N.K. Verma & A.N. Rai and *D. pachyderma* (Syd. & P. Syd.) N. Pons & B. Sutton are much longer and more septate compared with *D. curvulata* (TABLE 1). The new species resembles *D. africana* Crous & U. Braun, which has shorter, thicker, branched, and less septate conidiophores and narrower conidia without any euseptation.

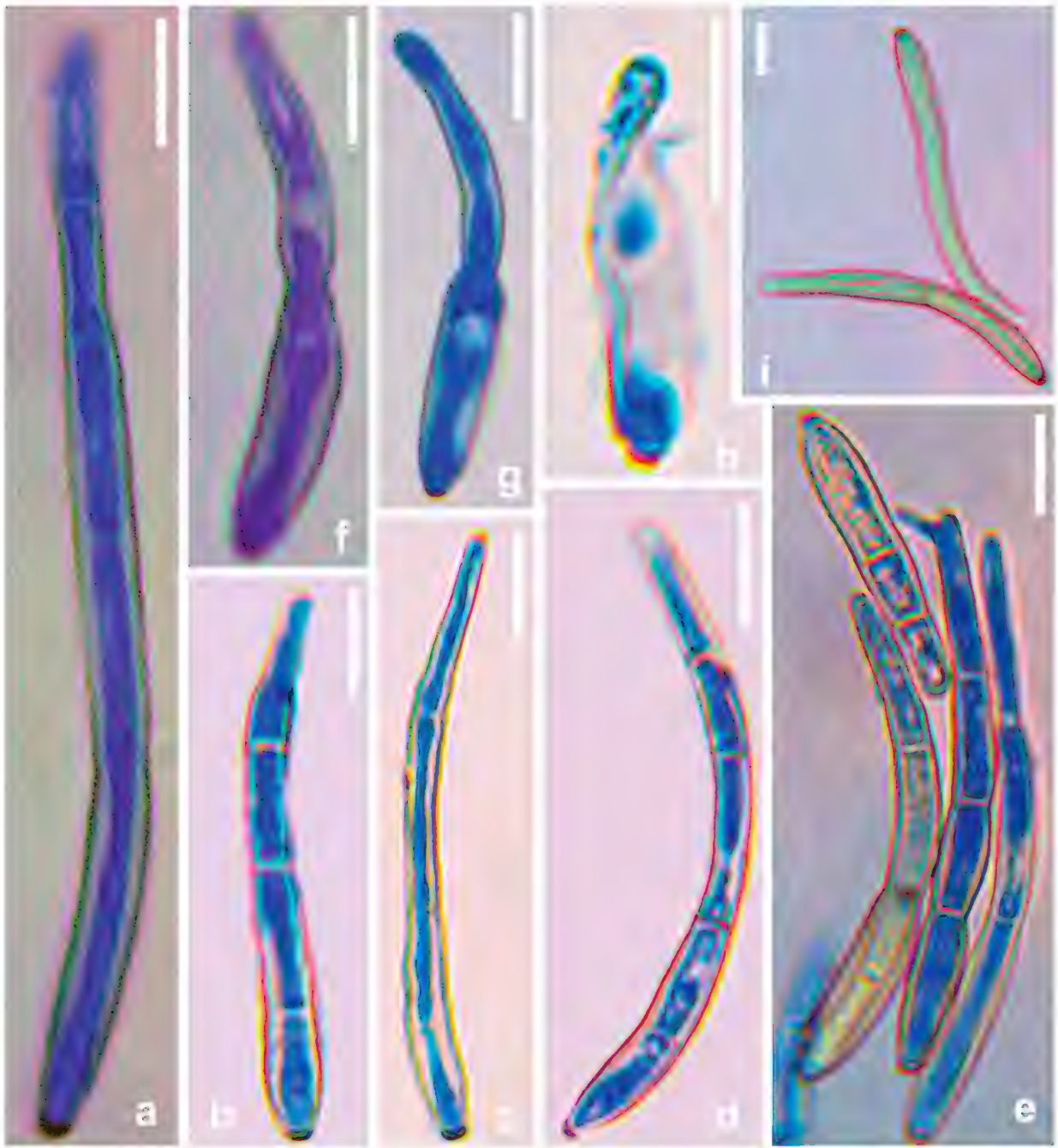


FIG. 3. *Distocercospora curvulata* (ex holotype, AMH 10239). Conidia. Scale bars = 10 μ m.

TABLE 1. Comparative morphology of *Distocercospora* species.

SPECIES.	STROMATA (µm)	CONIDIOPHORES		CONIDIA		HOST	REFERENCE
		SEPTATION	NATURE	SIZE (µm)	SEPTATION		
<i>D. africana</i>	15–50 × 10–40	1–2(3)	B	15–80 × 3–10	1–5(6)–distoseptate	<i>Dioscorea</i> sp. (<i>Dioscoreaceae</i>)	Crous & Braun 1994
<i>D. curvulata</i>	12–46 × 8–30	1–7	UB	34–92 × 3.5–7	0–3–euseptate; 0–5–distoseptate	<i>Causonis trifolia</i> (<i>Vitaceae</i>)	This paper
<i>D. indica</i>	30–160	Pluriseptate	B	80–1000 × 4–6	0–5–distoseptate	<i>Holoptelea integrifolia</i> (<i>Ulmaceae</i>)	Verma & Rai 2014
<i>D. pachyderma</i>	Absent	Pluriseptate	B	316–490 × 3–5	1–5–distoseptate	<i>Dioscorea</i> spp. (<i>Dioscoreaceae</i>)	Kirschner & al. 2004

B = branched, UB = Unbranched.

Acknowledgments

The authors express their sincere gratitude to Dr. R.F. Castañeda Ruiz and Dr. Patricia Oliveira Fiuza for their critical review of the manuscript with useful suggestions. The authors are thankful to the curator of AMH, ARI, Pune for accepting the holotype material and providing an accession number there off. Authors are also thankful to the Head of the Department of Botany, Institute of Science, Banaras Hindu University, Varanasi for providing laboratory facilities. Dr. Lorelei Norvell's editorial review and Dr. Shaun Pennycook's nomenclature review are greatly appreciated.

Literature cited

- Awasthi N, Singh R, Kumar S. 2016. A new species of *Pseudocercospora* on *Andrographis paniculata* from Central India. *Sydowia* 68: 27–33.
- Braun U, Nakashima C, Crous PW. 2013. Cercosporoid fungi (*Mycosphaerellaceae*) 1. Species on other fungi, *Pteridophyta* and *Gymnospermae*. *IMA Fungus* 4(2): 265–345. <https://doi.org/10.5598/imafungus.2013.04.02.12>
- Braun U, Crous PW, Nakashima C. 2014. Cercosporoid fungi (*Mycosphaerellaceae*) 2. Species on monocots (*Acoraceae* to *Xyridaceae*, excluding *Poaceae*). *IMA Fungus* 5(2): 203–390. <https://doi.org/10.5598/imafungus.2014.05.02.04>
- Braun U, Crous PW, Nakashima C. 2016. Cercosporoid fungi (*Mycosphaerellaceae*) 5. Species on dicots (*Anacardiaceae* to *Annonaceae*). *IMA Fungus* 7(1): 161–216. <https://doi.org/10.5598/imafungus.2016.07.01.10>
- Crous PW, Braun U. 1994. *Cercospora* species and similar fungi occurring in South Africa. *Sydowia* 46(2): 204–224.
- Crous PW, Braun U. 2003. *Mycosphaerella* and its anamorphs: names published in *Cercospora* and *Passalora*. CBS Biodiversity Series 1. CBS Utrecht, The Netherlands. 571 p.
- Hawksworth DL. 1974. *Mycologist's handbook*. Commonwealth Mycological Institute, Kew. 231 p. [https://doi.org/10.1016/S0007-1528\(74\)80047-7](https://doi.org/10.1016/S0007-1528(74)80047-7)
- Kirschner R, Piepenbring M, Chen CJ. 2004. Some cercosporoid hyphomycetes from Taiwan, including a new species of *Stenella* and new reports of *Distocercospora pachyderma* and *Phacellium paspali*. *Fungal Diversity* 17: 57–68.
- Kumar S, Singh R. 2015a. *Pseudocercospora bischofigena*, a new cercosporoid fungus from northeastern Uttar Pradesh, India. *Czech Mycology* 67(1): 39–44. <https://doi.org/10.33585/cmy.67105>
- Kumar S, Singh R. 2015b. *Passalora musicola*, sp. nov. – a new Indian hyphomycete. *Sydowia* 67: 21–23.
- Kumar S, Singh R. 2016. *Passalora caesalpiniiicola* sp. nov. from India on *Caesalpinia bonduc*. *Mycotaxon* 131: 25–30. <https://doi.org/10.5248/131.25>
- Kumar S, Singh R, Gond DK, Saini DC. 2012a. Two new species of *Corynespora* from Uttar Pradesh, India. *Mycosphere* 3(5): 864–869. <https://doi.org/10.5943/mycosphere/3/5/11>
- Kumar S, Singh R, Saini DC, Kamal. 2012b. A new species of *Corynespora* from terai forest of northeastern Uttar Pradesh, India. *Mycosphere* 3(4): 410–412. <https://doi.org/10.5943/mycosphere/3/4/3>
- Kumar S, Singh R, Singh DP, Kamal. 2018. *Crousobrauniella*, an interesting new foliicolous hyphomycetous genus from Uttar Pradesh, India. *Kavaka* 50: 64–68. <https://doi.org/10.5248/131.25>

- Kushwaha P, Singh R, Chaurasia B. 2020. *Ramularia titarpaniensis*—a new species of ramularioid complex from central India. *Phytotaxa* 429(4): 274–280. <https://doi.org/10.11646/phytotaxa.429.4.3>
- Savile DBO. 1962. Collection and care of botanical specimens. Canadian Department of Agriculture, Research Branch, Publication 1113: 1–124. <https://doi.org/10.5962/bhl.title.53755>
- Singh R, Kamal. 2011. Two new species of *Corynespora* from northeastern Uttar Pradesh, India. *Mycotaxon* 118: 123–129. <https://doi.org/10.5248/118.123>
- Singh R, Kumar S, Kamal. 2011. Two new species of *Passalora* and *Pseudocercospora* from northeastern Uttar Pradesh, India. *Mycotaxon* 117: 137–143. <https://doi.org/10.5248/117.137>
- Singh R, Chaurasia B, Shukla K, Upadhyaya PP. 2012. *Passalora aseptata*, a new cercosporoid fungus from northeastern Uttar Pradesh, India. *Mycotaxon* 120: 461–463. <https://doi.org/10.5248/120.461>
- Singh R, Kumar S, Singh A, Shukla K. 2013a. A new species of *Parapyricularia* from India and a key to all species. *Sydowia* 65(2): 337–342.
- Singh R, Kumar S, Saini DC, Upadhyaya PP, Kamal, Braun U. 2013b. Diversity of *Passalora* on *Ficus*. *Mycological Progress* 12: 637–643. <https://doi.org/10.1007/s11557-012-0870-6>
- Singh R, Singh A, Kumar S, Upadhyaya PP, Castañeda-Ruiz RF. 2014a. Two new species of *Zasmidium* from northeastern Uttar Pradesh, India. *Nova Hedwigia* 98(1–2): 257–263. <https://doi.org/10.1127/0029-5035/2013/0137>
- Singh A, Kharwar RN, Singh R, Kumar S. 2014b. A new species of *Zasmidium* (*Mycosphaerellaceae*) from India. *Sydowia* 66 (2): 309–312.
- Singh A, Singh NK, Singh PN, Singh R, Dubey NK. 2019. Additions to *Ochroconis* from India. *Phytotaxa* 427 (3): 186–199. <https://doi.org/10.11646/phytotaxa.427.3.2>
- Singh R, Verma SK, Yadav S, Bhojak P, Kumar S. 2020. Morphology and phylogeny of *Pseudocercospora hamiltoniani*—a new species comparable to *Sirosporium* from Uttarakhand, India. *Phytotaxa* 458(4): 281–293. <https://doi.org/10.11646/phytotaxa.458.4.4>
- Verma NK, Rai AN. 2014. *Distocercospora indica*, a new dematiaceous hyphomycete from central India. *Mycotaxon* 127: 97–101. <http://dx.doi.org/10.5248/127.97>
- Videira SIR, Groenewald JZ, Nakashima C, Braun U, Barreto RW, de Wit PJGM, Crous PW. 2017. *Mycosphaerellaceae* – chaos or clarity? *Studies in Mycology* 87: 257–421. <https://doi.org/10.1016/j.simyco.2017.09.003>